CHAPTER II

PRIVATE ECONOMIC COSTS OF OZONE ATTAINMENT

Existing estimates of the costs associated with current legislative proposals to reauthorize the Clean Air Act share most of the limitations and uncertainties discussed in Chapter I. Any economic analysis is further complicated by the fact that the precise regulatory requirements of the proposals must be constructed from the statutory language. The Congressional Research Service (CRS) and the Office of Technology Assessment (OTA) have, nevertheless, estimated the private costs of some of the key provisions of Congressional proposals that would revise the attainment schedules and requirements for the national ozone standard. These and other cost estimates are reviewed here to illustrate the types of concerns and issues raised in Chapter I. The proposals' costs to federal, state, and local governments will be examined in Chapter III.

Existing estimates of ozone attainment control costs tend to focus only on the negative consequences of the proposals. In this regard, they tend to overestimate actual cost burdens. This is particularly true since most of the estimates fall into the "compliance cost" category and may not depict explicitly the full range of possible technological and economic responses, nor the benefits of reducing ozone concentrations. One final general point concerning the estimates reviewed below is that all of them relate to the provisions of the Senate bill (S. 1894). To the extent that the existing House bill (H.R. 3054) adopts different approaches, its costs may vary from those reported here.1/ OTA argues that the costs of the two bills (or of the Environmental Protection Agency's proposal, for that matter) are unlikely to differ substantially because meeting the similar attainment deadlines will require most areas now out of compliance to implement all available control methods. Even then, OTA questions whether the reductions required for attainment can be achieved in all areas.

OVERALL ESTIMATES OF PRIVATE-SECTOR COMPLIANCE COSTS

Table 1 presents estimates of the cost of meeting the major ozone attainment provisions in H.R. 3054 and S. 1894, made by CRS, OTA, and the Environmental Protection Agency (EPA).

All of these estimates involve different sets of assumptions and different methods of calculation, but they share several common characteristics that are worth noting in order to better understand the differences between the estimates:

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1. In addition, at the time of this writing, at least one other House proposal concerning ozone attainment revisions was being developed. This proposal was not incorporated explicitly in this analysis.

TABLE 1. GOVERNMENT AGENCY ESTIMATES OF THE ANNUAL COST OF SELECTED OZONE ATTAINMENT PROVISIONS (In billions of 1988 dollars)a/

Provision	CRS Low (Costs in 2000)	CRS High (Costs in 2000)	EPA Low (Costs in 1992)	EPA High (Costs in 1992)	OTA (Costs in 2003)
Stationary Source VOC	3.91	6.39	n/a	n/a	2.42
Area Sources	--b/	--b/	--	--	0.96
Tailpipe Standards	1.20	3.10	1.24c/	1.24c/	2.51
Enhanced Inspection and Maintenance	0.46	2.05	1.35	1.35	3.38
Stage II	0.08	0.12	0.05	0.09	0.26
Alternative Fuels	0.14	0.38	--	--	0.88
TCMs	0.00	0.23	--	--	--
Onboard	0.20	0.80	0.19	0.19	0.79
RVP Control	0.45	0.45	0.21	0.77	0.27
Total	6.44	13.52	4.23	4.83	11.48

SOURCES: Compiled by the Congressional Budget Office from publications of the Congressional Research Service, the Office of Technology Assessment, and the Environmental Protection Agency. CRS estimates of costs in 2000 are reported in CRS reports 87-751S and 88-297S. OTA estimates of costs in 2003 are reported in Office of Technology Assessment, "Urban Ozone and the Clean Air Act: Problems and Proposals for Change," April 1988. EPA estimates of costs in 1992 are reported in "Detailed Documentation of Costs of Senate Clean Air Act Amendments," with the exception of the estimates for Stage II and Onboard Control that are reported in Federal Register, vol. 52, no. 160, Wednesday, August 17, 1987.

NOTE: n/a = not applicable

a. None of the totals should be viewed as representing the full cost to any area of attaining the ozone standard. The CRS and EPA numbers are estimates of some specific provisions of S. 1894. OTA's estimates assume that all non-attainment areas will have to implement all available emissions reduction strategies to reach attainment, and many areas will still exceed the standard after implementing these controls.

b. CRS includes the cost of area sources in its stationary source estimate.

c. EPA does not estimate the cost of heavy-duty diesel trucks meeting the bill's NO_x standard because it considers the standards to be technically infeasible.

- The cost estimates are predicated on the analysts' interpretation of the bills' requirements, and on assumptions concerning how the requirements would be implemented by EPA and the states. Some of the provisions are relatively straightforward in this regard; others are subject to greater uncertainty. For example, the House bill may allow states close to attainment relatively more flexibility than does the Senate bill in terms of actions required to meet the air quality goals. Thus, the cost analysis has to adopt assumptions concerning state responses that may or may not be realized.

- The analyses use somewhat different baselines for estimating costs. For example, current EPA estimates of the Senate bill assume that some proposed legislative requirements will be implemented by EPA regardless of Congressional action. Specifically, EPA already has proposed changes in onboard and RVP controls. The different baselines confuse simple comparisons of the estimates and can lead to large variations.

- While the House and Senate bills include a number of relatively similar requirements, there are significant differences. These include the numbers of cities or areas to which specific requirements would apply and the time frames in which they would take effect. It is not clear whether these differences are likely to affect the cost estimates.

- All of the estimates fall into the general category of engineering costs. They reflect principally the bills' first-order additional capital and operating maintenance requirements, and do not attempt to predict economic responses to these increased costs.

- All of the estimates in Table 1 assume that the same level of costs will be incurred year after year. For example, technology-based controls on stationary sources are estimated to cost the same on an annual basis regardless of the length of time before such controls are required. Given the deadlines for meeting the bills' various requirements, however, costs are likely to vary substantially over time if states delay certain types of control requirements until absolutely necessary. Table 2 shows OTA estimates of this time variance. The overall impact of timing on the total costs of the requirements could be significant.2/

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2. In general, as costs are pushed forward in time, the total costs over the period of the analysis expressed in terms of present values are lower. The is true for two important reasons. First, a dollar spent today is more expensive than a dollar spent at some point in the future. Further, a longer compliance period generally will allow expanded opportunities for the development of less costly technology or the adoption of other, potentially less expensive, control options such as product or input substitution or process change.

TABLE 2. ESTIMATED ANNUAL COSTS OF SPECIFIC OZONE ATTTAINMENT PROVISIONS OVER TIME
(In billions of 1988 dollars)

Provision	1993	1998	2003
Stationary Source Controls	2.07	2.19	2.42
Area Sources	0.88	0.92	0.96
Tailpipe Standards	0.63	1.75	2.51
Enhanced I/M	2.73	3.05	3.38
Stage II	0.21	0.24	0.26
Alternative Fuels a/	0.94	0.84	0.88
Onboard	0.21	0.53	0.79
RVP Control	0.26	0.26	0.27
Totals	7.93	9.79	11.48

SOURCE: Office of Technology Assessment, "Urban Ozone and the Clean Air Act: Problems and Proposals for Change," April 1988.

a. Based on costs of methanol use.

- The bases for the cost analyses reviewed here are sometimes unclear, but it is presumed that all costs are in 1988 dollars unless stated otherwise--that is, in terms of the value of a dollar in 1988 incurred in each year the provisions are in effect.

The following pages provide additional detail on some of the specific assumptions and issues underlying the estimates for individual provisions.

COSTS OF SPECIFIC PROVISIONS

The various strategies adopted by the proposed legislation to extend ozone attainment deadlines result in a wide assortment of cost estimates. The underlying methods or protocols for a selected set of these estimates are evaluated below. While some of these are predicated on formal cost models, others might best be regarded as educated guesses--particularly the cost estimates associated with technology-forcing provisions and control measures affecting smaller, currently unregulated sources.

Industrial Stationary Source Controls

The House and Senate bills place certain VOC and NO_x reduction requirements on a wide range of industrial sources in various regions.3/ Given the new threshold emission levels adopted by the bills, affected sources could include both large chemical or petroleum production facilities and relatively small dry cleaning or bakery firms. In general, these sources will be required to adopt specific control technologies (referred to as "reasonably available control technologies" or RACT) to reduce their emissions. These costs are estimated to range from $2.4 billion to $6.4 billion annually for the Senate bill.

Most of the estimates for the stationary source controls are based on estimates of emission reduction levels (in millions of tons) necessary to meet attainment deadlines, multiplied by an estimate or range of estimates of the average dollar cost per ton of doing so. The OTA analysis of the Senate bill is one important exception. OTA estimates the emission reductions that could be achieved through the application of RACT in 43 industrial categories, and then multiplies these estimates by cost-per-ton control estimates specific to each category.

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3. Volatile organic compounds (VOCs) are a class of substance that vaporize at certain temperatures and atmospheric conditions. In combination with nitrogen oxides (NO_x), emitted from the combustion of fossil fuels and sunlight, VOCs can react to form lower atmospheric ozone. VOCs are emitted from a diverse set of mobile and stationary sources, including house paints, automobile engines, pesticides, and petroleum refineries. Mobile source controls include tailpipe standards, onboard refueling controls, etc. Stationary source controls can be directed toward point stationary sources such as commercial or industrial facilities, or area sources including pesticide applications, architectural coatings, and solvents.

The accuracy of these estimates in terms of actual compliance costs depends on the degree to which the cost-per-ton estimates reflect the specific characteristics of the regulated sources. Properly constructed or specified, the per-ton costs would take account of:

- The degree to which any specific source or category of sources is already controlling VOC emissions;
- Differences in the industrial processes that emit VOCs;
- Options available to sources to control emissions--from technological controls to product or input substitutions; and
- Differences, if any, between the control options available to smaller firms and those available to large firms.

The OTA analysis appears to be the best in addressing at least some of these considerations. By taking account of existing levels of control and differences among emission sources in the cost of control, the OTA study acknowledges that not all sources of VOC are alike. The total estimates for stationary-source VOC control appear, however, somewhat invariant to the use of an average versus a source-specific control cost. The more important consideration may be differences in cost of control between large VOC emission sources, say those emitting over 100 tons, compared to smaller sources--those down to 25 tons in the Senate bill. Although some RACT standards are in place for this size of source, there has been relatively little experience with the kinds of controls that would be appropriate and effective for these source categories. It is possible that many of them would have fewer and relatively more expensive reduction options than the larger sources. For example, a large emission source may find it less expensive on a per-ton basis to vent several VOC emission points to a single control device. A single smaller source, on the other hand, may be forced to adopt a more expensive strategy. The analyses conducted so far throw little light on this potential problem. Given that the House and Senate bills bring a potentially large number of small, relatively uncontrolled, sources into the regulatory system, this is an important concern.

Compliance costs provide limited insight as to the responses of firms when faced with the prospect of increased cost burdens. For one thing, as already noted, the technologies that serve as the basis for cost estimation are unlikely to reflect the full range of control options available to any specific firm. Moreover, a host of economic responses is also possible and likely.

National Standards for Stationary and Area VOC Sources

In addition to the technology-based control required in specific nonattainment regions, the House and Senate bills require developing and implementing national emission standards for specified classes of VOC sources. Over and above the RACT provision, these requirements will ultimately direct emission reduction efforts at large and diverse classes of point and area VOC sources that could include degreasing operations, automobile body paint facilities and shops, and

other small facilities. OTA has provided an estimate of the engineering cost burdens of the Senate version of standards but only for two of the five source categories: solvents and architectural coatings. Assuming a cost-per-ton control of $2,000, OTA arrives at a cost for these standards of around $960 million per year. Although these estimates were made on the basis of the Senate bill, the House requirements are quite similar.

The accuracy of the OTA estimates hinges on the same kinds of concerns expressed above: the degree to which these sources are already controlled; the possibility of relatively low-cost production substitution (for example, switching to water-based paints); and the other available technological control options. The potential impact of these issues is particularly acute given the wide diversity of sources affected by these provisions. Presumably many of the sources, because of their size, have generally not been subject to controls. This would suggest that reductions might be achieved relatively inexpensively. On the other hand, because some of the sources are small they may not be able to avail themselves of technology-based controls, limiting their overall flexibility to achieve cost-effective reductions.

Stage II Controls

The costs of installing and maintaining "at-the-pump" gasoline vapor recovery devices or Stage II controls, as required by the House and Senate bills, have been estimated by several organizations. These estimates all assume that every nonattainment region will implement this control. This assumption seems reasonable given the Senate bill requirements. The House bill, however, requires Stage II only in severe areas, suggesting lower overall costs. If, as OTA suggests, most nonattainment regions will have to implement every available control strategy regardless of specific legislative requirements, costs are likely to be the same under either bill.

In general, the basis for these engineering cost estimates is either the cost per gasoline pump or station for the required technology (multiplied by the number of affected pumps or stations) or an estimate of the cost-per-ton control (multiplied by the expected emission reductions). The relatively small range of costs associated with these controls reflects probably the relatively homogeneous nature of the technology and control sources.

One somewhat controversial element of Stage II costs concerns the inconvenience costs to car drivers of having to use a Stage II-equipped pump. EPA has argued that, everything else being equal, car drivers would be willing to pay some amount of money to avoid having to follow the special handling procedures of the stage II pump apparatus. Such inconvenience costs are difficult to measure, since they are not reflected in market transactions. EPA has provided an estimate of 10 cents per refueling event as an approximation of the inconvenience costs to car drivers. The basis for this estimate is unclear, and there is little in the way of an analytical baseline for comparison. If Stage II was implemented in all nonattainment areas, even this small unit cost would result in relatively large aggregate costs of approximately $141 million to $209 million annually.

Alternative Fuels

Under both the House and Senate bills, new vehicles in fleets of a certain size and in certain areas will have to be capable of using alternative fuels such as methanol, ethanol, or natural gas. In addition, the House bill requires that at least 30 percent of all new vehicles in severe areas be capable of using these same fuels by 1997. The primary determinants of total direct costs to fleet owners (public or private) are the number of areas in which the requirement holds, the type of fuel selected for alternative use, the size of the fleet to which the requirement applies, the cost of designing vehicles capable of using those fuels, and, most important, whether the redesigned vehicles actually use alternative fuels. This last point is important given the current price differential between gasoline and most alternative fuels. The CRS estimated a range of $140 million to $380 million as the cost of the Senate bill's fleet requirement for converting fleets of 50 or more units to methanol or natural gas.

Enhanced Inspection and Maintenance (I/M) Programs

These provisions are discussed in Chapter III. It is worth noting, however, that a substantial portion of the costs are likely to be passed on to owners of vehicles (through inspection or registration fees and repair costs).

Offset Requirements

Current law requires new sources in nonattainment areas to obtain offsetting reductions in emissions at a ratio of greater than 1 to 1. EPA's current policy requires a 1.2 to 1 offset ratio for all major sources (over 100 tons) in some instances. H.R. 3054 requires an offset ratio of 1.2 to 1 for all new sources over 25 tons in serious areas, and an offset ratio of 1.5 to 1 for all new sources over 10 tons in severe areas. S. 1894 requires offset ratios of 2 to 1 for new sources over 25 tons in severe or most severe areas. The key issue affecting the costs of the proposed offset requirements is whether they are particularly binding given the percentage reduction requirements. The Senate bill, for example, already requires that severe nonattainment areas reduce overall emissions of VOCs by 65 percent by 1997. These reduction requirements may, in some areas, force nonattainment regions to adopt even more stringent offsets than those in the proposed legislation.

Fees

Both H.R. 3054 and S. 1894 require that severe areas impose a per-ton fee on stationary sources emitting over 25 tons of VOCs or NO_x. The Senate bill requires that the fee be at least $100 per ton and be imposed beginning in 1993; the House bill leaves the fee unspecified, but requires that it be imposed beginning in 1990. CRS estimates that if the fee was set at $100 per ton and affected 15 areas, it would generate roughly $100 million per year. But this estimate assumes that emissions would actually increase in these areas between now and 1993, an unlikely assumption given the required percentage reductions

and the stringent requirements for new sources. The estimate also assumes 15 areas would be affected. This appears to overstate the cost given that only four areas fall into the category of severe or most severe areas according to the most recent data. This bias may be partially offset by the difficulties areas have had attaining a specific deadline in the past.

H.R. 3054 also authorizes the EPA Administrator to promulgate regulations imposing a fee of not more than $.05 per gallon on the sales of gasoline and diesel fuel in severe areas. The revenues of this fee are to be available for making grants to states and local governments in those areas to implement transportation control measures.

Fuel Volatility

To limit gasoline volatility during warm months, both H.R. 3054 and S. 1894 would require that the Reid Vapor Pressure of gasoline be reduced to 9.0 pounds per square inch, or approximately 80 percent of its current level, by 1992 (the Senate bill requires this standard by 1990). Cost estimates of this provision range from $210 million to $770 million per year. The primary method for lowering gasoline volatility is to reduce the butane content of the fuel. This process would increase the cost to refiners to the extent they have locked into contracts for butane or would have to make changes in the refining process to alter fuel composition. Economywide costs could be substantially lower, however, if reducing butane content increased the fuel economy of vehicles. Lower-volatility fuels might also increase the drivability of some cars. All of these costs are considered in a range of costs estimated by EPA in its proposed rules on volatility.4/ The EPA estimates are the basis for all CRS and OTA estimates of this provision. The reason for the differences between the CRS and OTA estimates is unclear, but they appear to reflect differing assumptions about refiners' ability to break contracts or the value of reducing RVP in attainment areas.

None of the existing estimates takes account of the incremental cost of the earlier deadline for S. 1894. The less time refiners are allowed to meet these requirements, the more significant the short-term cost increase. For example, the EPA estimate of the S. 1894 RVP requirement reflects the approximate annual cost in 1992. EPA notes, however, that the RVP reduction deadline of April 1990 would be possible to meet only through large-scale short-term product switching, which could add an incremental cost of $2 billion during 1990 and 1991.

Onboard Controls

The House and Senate bills would require that onboard controls (VOC collection canisters in the trunks of cars) be installed on all vehicles sold after 1990 and 1991, respectively. The range of cost estimates reflects the different views on

4. 52 FR 31274, August 19, 1987.

the difficulty of fitting onboard canisters into current car designs. EPA argues that the onboard controls would be small enough to fit onto current car designs without major retooling, and estimates the per-vehicle cost as ranging from $14 to $19 per vehicle. Some auto manufacturers dispute this view, arguing that fitting even small canisters into some small vehicle designs would be impossible without substantial retooling, at a cost of between $80 and $110 per vehicle, or around 1 percent of the average price of a new car.5/

Three additional arguments cloud the debate about onboard controls. Opponents of these canisters argue that they would increase the likelihood of fire in the event of a crash. This argument is based more on the premise that any control that complicates the fuel line will increase the chance of failure than on evidence that such controls are particularly dangerous. Opponents also argue that positioning the canisters will require manufacturers to reduce either trunk size or fuel tank size. In either case, they argue that the design change would result in consumer inconvenience costs of up to $25 per car in the case of reduced trunk size. (Larger cars might enjoy a relative cost advantage in this respect.) Finally, the EPA argues that onboard controls would increase fuel economy, and therefore, it includes a $5 credit for fuel recovery in the $14 per car estimate.

Tailpipe Standards

One of the controversial provisions of both bills involves the tightening of mobile source emission standards for carbon monoxide (CO), nitrogen oxides (NOx), and hydrocarbons. Although the bills set similar standards, they differ in the year by which compliance must be met and in the type of vehicle concerned. These differences aside, the costs to automobile manufacturers of these requirements appear to be primarily determined by their technological feasibility and the costs of increased automobile recalls and expanded warranty claims. CRS, EPA, and OTA have estimated the costs of the Senate provisions as ranging from $1.2 billion to $3.1 billion annually.

Some general observations concerning the estimates are in order. First, the hardware cost estimates assume that automobile manufacturers would be able to design a technology capable of meeting the requirements. CRS states that virtually all domestic manufacturers have testified that they are unable to meet these standards. CRS does, however, suggest a range of $50 to $150 as the cost per car, based in part on estimates used by EPA. OTA uses an estimate of around $140 per car (including NO_X control). Other observers have noted that the automobile industry made the same claim in regard to earlier emission control standards, but was ultimately able to meet them. At the same time, the proposed new standards involve more than a simple marginal improvement in

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5. See testimony of Teiji Iida, Manager, Toyota Motor Corp. before the Subcommittee on Environmental Protection of the Senate Committee on Environment and Public Works, April 9, 1987.

emissions: they may require new technological developments. It is beyond the scope of this paper to resolve the dispute, but the uncertainty associated with the estimates should be noted.

The other cost elements contained in the CRS study relate primarily to the increased costs to automobile manufacturers of ensuring that the tailpipe emission control technology continues to operate properly over its warranty period. This period has been expanded under the Senate bill to 10 years or 100,000 miles. The CRS estimates assume that certain percentages of cars would have to be recalled during the 10-year/100,000-mile time period for manufacturer repair, and that a doubled warranty period would result in doubled warranty costs. These assumptions are based at least in part on the industry's claim that it will be difficult to guarantee continued performance of emission control equipment, particularly in larger six- or eight-cylinder vehicles. Again, it is only possible to record the uncertainty associated with these estimates. Other potential consequences of these provisions are discussed in a later section on industry impacts.

INDUSTRY-LEVEL COSTS

The compliance cost estimates for the various ozone attainment provisions presented earlier are not specific to any particular industry except for some of the mobile source controls. Obviously, however, these costs will be distributed differently across industries, depending on their relative emission levels, the existing levels of control, and the various technological options available in each industry. The translation of these costs into specific measures of industry performance (such as profits, employment, etc.) will depend on how the individual firms in an industry respond to the engineering cost burdens imposed by the regulations.

Ideally, industry compliance costs would be constructed from an aggregation of firm-level costs, and would explicitly allow for individual firm responses to engineering cost burdens that would minimize the costs to each firm. Unfortunately, none of the existing ozone attainment cost estimates have been assembled in this manner.6/ In fact, there is a relative dearth of empirical analyses relating to industry-specific costs and impacts. It is possible, nevertheless, to put at least some of the estimated cost burdens into the context of industry-level costs and impacts.

Distribution of Costs by Industrial Sector

Lacking a formal analysis of industry-level costs associated with the House or Senate ozone attainment proposals, this paper can offer only a crude assessment

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6. Several industry-specific cost studies have been prepared by industrial organizations. These are not reviewed here except for comparative purposes.

of the cost burden on specific industries. Tables 3 to 5 break down estimated 1985 emissions of VOCs by various major source categories and by various industrial processes. The initial cost burden of H.R. 3054 to these sectors can be roughly approximated by allocating the estimated total ozone control costs on the basis of each sector's estimated emissions. In the case of transportation, storage, and marketing, the emissions and the associated control costs are allocated to petroleum refining. Emissions and associated control costs for industrial processes and industrial surface coating are allocated across the remaining industrial processes in Table 5. On this basis, the organic chemicals, petroleum, and polymers and resins sectors bear the greatest absolute cost burdens. The distribution of the burden is roughly similar to industries' value of shipments (Table 6), a dollar measure of industry output, although larger relative impacts are shown for vegetable oil processing facilities, petroleum refineries, and synthetic rubber manufacturing. In only one industry is the initial cost burden greater than 1 percent of the 1987 value of shipments.

These industry-level cost burden estimates should be viewed with extreme caution. They assume that all sources face roughly the same level of per-unit control costs. In fact, the average per-ton control cost implied by these tables is substantially less than those estimated by OTA for the individual industries. Further, the estimates assume that the industrial processes considered will not bear any other emission reduction costs from other major sources not included (for example, other solvent use and other miscellaneous sources). Finally, the estimated cost burdens are really compliance costs and do not really match the definition of industry-level costs given earlier, since they do not take account of possible economic responses on the part of the affected sources. At best they should be viewed as crude first-order estimates showing which industrial sectors may be most adversely affected. They say very little about the potential ability of these industries to pass on price increases, hold market share, or realign production processes.

A similar exercise was conducted in a study prepared for The Business Roundtable (BRT).7/ It estimated that 300,000 to 600,000 jobs in the primary manufacturing industries (approximately 1.5 percent to 3.0 percent of their total work force) could be lost as a result of annual incremental expenditures of $20 billion under selected provisions of the Senate bill. The BRT estimates, however, like those in Tables 4 through 6, are not derived from an explicit model of the industries that make up the primary manufacturing sector. Rather, they appear to be based on a set of "rules of thumb" relating compliance costs to production cost changes, losses in domestic market shares, and job losses. As a consequence, they are completely static, making no allowance for cost-reducing technological or economic responses. They are also sector-specific in that they ignore potential employment increases in other sectors. The BRT estimates may best be viewed as an extreme worst-case scenario. While pollution control costs of the magnitude considered by BRT could reasonably be expected to have deleterious effects if imposed on this one sector, exacerbating the current

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7. The Business Roundtable, *Analysis and Impact of S. 1894: "The Clean Air Act Standards Attainment Act of 1987,"* prepared by R.M. Dodd and Company (March 1988).

TABLE 3. SUMMARY OF 1985 U.S. VOC EMISSIONS
(In thousands of tons per year)

Source Category	Point Source Emissions	Area Source Emissions	Percent of Total Emissions
Storage, Transportation, and Marketing of Petroleum Production	324	1,000	7
Industrial Processes	1,052	--	6
Industrial Surface Coating	525	--	3
Other Solvent Use (degreasing, dry cleaning, graphic arts, adhesives, solvent extraction processes, etc.)	268	4,700	26
Other Miscellaneous Sources (fuel combustion, solid waste disposal, open burning, waste solvent recovery processes, and stationary internal combustion engines)	242	3,600	20
Mobile Sources	--	7,300	38
Total	2,412	16,700	100

SOURCE: Environmental Protection Agency, *National Emissions Data System.*

TABLE 4. ESTIMATED ANNUAL OZONE COMPLIANCE COSTS BY VOC SOURCE CATEGORY (In millions of 1988 dollars)

Source Category	Cost
Storage, Transportation, and Marketing of VOCs	800
Industrial Processes	690
Industrial Surface Coating	340
Other Solvent Use (degreasing, dry cleaning, graphic arts, adhesives, solvent extraction processes, etc.)	2,980
Other Miscellaneous Sources (fuel combustion, solid waste disposal, open burning, waste solvent recovery processes, and stationary internal combustion engines)	2,300
Mobile Sources	4,360
Total	11,480

SOURCE: Congressional Budget Office, based on OTA compliance costs estimates allocated to source category on the basis of emission levels.

TABLE 5. ESTIMATED ANNUAL CONTROL COSTS OF 1985 VOC EMISSIONS BY MAJOR INDUSTRIAL POINT SOURCES
(In tons per year and millions of 1988 dollars)

Industry	Emissions a/	Costs
Petroleum Refining	200,470	196
Lube Oil Refining	2,507	--
Organic Chemicals	255,803	250
Inorganic Chemicals	12,836	13
Fermentation Processes	24,787	24
Vegetable Oil Processing	8,555	8
Pharmaceuticals	4,848	--
Plastic Products	9,244	9
Rubber Tires	20,185	20
SBR Rubber	52,129	51
Polymers and Resins	112,378	110
Synthetic Fibers	27,073	27
Iron and Steel	48,096	47
Others	273,248	267
Total	1,052,166	1,030

SOURCE: Congressional Budget Office, based on OTA cost estimates allocated on the basis of 1985 emission levels.

a. May not sum to total because of rounding.

TABLE 6. ESTIMATED OZONE CONTROL COSTS AS A PERCENTAGE OF SELECTED INDUSTRIES' 1987 VALUE OF SHIPMENTS

Industry	Value of Shipments a/	Costs
Petroleum Refining	117,243	.85
Lube Oil Refining	--	--
Organic Chemicals	47,290	.53
Inorganic Chemicals	18,570	.07
Fermentation Processes	20,386	.12
Vegetable Oil Processing	605	1.38
Pharmaceuticals	--	--
Plastic Products	67,218	.01
Rubber Tires	11,199	.18
SBR Rubber	9,505	.54
Polymers and Resins	23,854	.46
Synthetic Fibers	10,991	.24
Iron and Steel	53,091	.09

SOURCE: Congressional Budget Office control cost estimates, based on OTA cost estimates allocated on the basis of 1985 emission levels. Value of shipments is estimated for 1987, taken from U.S. Department of Commerce, Office of Business Analysis, Industrial Outlook data base.

a. In millions of 1987 dollars.

downward trend of employment in primary manufacturing, they should not be taken as indicating a corresponding loss in national economic performance.

The lack of industry-level cost information is one of the major barriers to a better understanding of the economic implications of the ozone attainment provisions. Even more troublesome is the lack of information on the size distribution of affected industrial sources, and on their control options. The bulk of current VOC emissions come from relatively small area sources of which very little seems to be known, and the costs associated with controls on these sources could far exceed the industry costs estimated here.

Automobile Manufacturing

Motor vehicles contribute roughly one-third of the ozone precursors emitted nationally. Attempts to control ambient ozone levels, therefore, inevitably require stringent controls on automobiles (so-called "tailpipe standards") and, in turn, lead to losses of output, employment, and profits in the automobile industry. The existing analyses of the cost burdens to the domestic automobile industry provide a basis for a case study of industry-level costs that illustrates some of the more important economic issues.

Both S. 1894 and H.R. 3054 would impose stricter standards on vehicles for emissions of hydrocarbons, nitrogen oxides, particulate matter, carbon dioxide, and (for nongasoline-powered vehicles) formaldehyde. In addition, both bills would require that 90 percent of the vehicles sampled as they come off a production line meet these standards (an increase from the current 60 percent); that entire fleets of vehicles could not be averaged to meet this requirement; that an idle test be added for all cars; and that pollution abating equipment be guaranteed by manufacturer's warranty under "normal" maintenance (as opposed to the current norm of "proper" maintenance) for 5 years or 50,000 miles. The Senate bill goes further, increasing the warranty period to 10 years or 100,000 miles and adding a cold-start test for carbon monoxide and separate high-altitude standards for light trucks.

At issue is whether the automobile industry can achieve these requirements. Industry representatives have expressed their concerns that the combined burden of these standards and tests might diminish the performance of their cars, much as similar regulatory standards are agreed to have done in the mid-1970s. They also note that no new technology exists that could be applied to automobile design to meet all of these requirements, and that bringing cars up to these specifications would require "fine tuning" of existing design features, perhaps by including additional catalyst loadings in converters and other changes. Studies by both CRS and OTA suggest that these problems are not insurmountable, although they would require forcing technology beyond its present limits, and that automobile manufacturers can meet these requirements, at a cost.8/

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8. Congressional Research Service, *Emission Controls and Motor Vehicles and Fuels*, CRS 88-297 S, April 13, 1988. Sierra Research, Inc., *The Feasibility and Costs of More Stringent Mobile Source Controls*, prepared for the Office of Technology Assessment (January 20, 1988).